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ABSTRACT

A series of three studies examined the validity of certain features of computer person and non-computer person stereotypes, including gender, academic achievement, communication apprehension, and receiver apprehension. First a pilot study developed a computer attitude estimate (CAE) scale and survey method. Subjects were 47 high school students and 42 college students who took the survey as part of class activities, 22 college students who received extra course credit for participation, and 12 college students who took the survey on a volunteer basis. Next, Study One reported a correlational analysis of computer attitude and stereotype features. Subjects were 230 high school students who took the survey as part of class activities, 46 college students who received extra course credit for participation, and five high school students and 10 college students who took the survey on a volunteer basis. Finally, Study Two addressed the generalizability of the first two studies by examining the factors in a distinctly different context. Subjects, 33 apprentices and three instructors of an electricians' union's apprentice program, completed the same survey as in the two previous studies. Findings of all three studies do not support either the computer or the non-computer person stereotype in totality, but show elements of truth in both of them, especially perceptions of higher academic achievement for the computer person and higher receiver apprehension for the non-computer person. (Four tables of data are included; 48 references and the survey instrument are attached.) (Author/RS)

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An Examination of the Validity of Computer and Non-Computer Person Stereotypes

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RUNNING HEAD: Computer Stereotypes

Abstract

The purpose of this research is to examine the validity of certain features of computer person and non-computer person stereotypes. These features are gender, academic achievement, communication apprehension and receiver apprehension. The examination is conducted through three studies. The first study is a pilot study to develop a computer attitude estimate (CAE) scale and survey method. The second study reports a correlational analysis of computer attitude and stereotype features. The third study addresses the generalizability of the findings. Findings do not support either the computer or the non-computer person stereotype in totality, but show elements of truth in both of them, especially perceptions of higher academic achievement for the computer person and higher receiver apprehension for the non-computer person.

An Examination of the Validity of Computer and Non-Computer Person Stereotypes

Most people in our society seem to be relatively calm about computers--most of the time. Problems, however, arise when people are forced to deal with computers and computer people (Zuboff, 1988) for school or employment. Then the question is asked, from others or from their own self-evaluation, "Are you a computer person?" Whether they answer "Yes," "No," or "As much as I need to be," depends, in part, on their own self-concepts and their stereotype of a computer person.

Social identities, or roles, are assumed, or rejected, based on attitudes toward objects and toward groups of individuals who also either accept or reject the object--a reference group (Barker, 1984). Once formed, these attitudes, and roles, affect subsequent perceptions and decisions and affect communication, usually in a negative manner, because stereotypical bias influences our perceptions of others', and our own, communication behaviors, and masks actual intentions and meanings (Sypher & Sypher, 1984).

This research focuses on the question of the validity of certain features of computer people and non-computer people stereotypes. Specifically, it looks at how communication apprehension, receiver apprehension, gender, and self-ratings of academic achievement are related to these stereotypes. Based on Barker's (1984) reference group, the terms "computer people" and "non-computer people" have been operationalized as those people who have either positive or negative attitudes towards computers.

The purpose of the research is to evaluate the validity of the stereotypes through correlational analysis. Stereotype validity has been operationalized in this research to be a consistent, objective, statistically significant relationship between a categorization feature and other attributes, in which the relationship is consistent with

the expectations of the stereotype. Given this definition, the lack of any statistically significant relationship can be construed as evidence of the invalidity of the stereotype attribute.

The object of establishing stereotype validity is that it may allow individuation of communicators on the basis of empirically differing attributes, rather than assumptions based on unexamined categorization (Pettigrew, 1977; Wilder, 1986).

If objects are a basic part of the formation of attitudes and roles, a review of the literature on human-computer interaction shows that computers have become objects, and sources, of serious sociological and philosophical conceptualizations, including the formation of a distinct computer sub-culture (Gerver, 1986; Hiltz, 1984; Minsky, 1986; Rheingold, 1985; Smith, 1984; Turkle, 1984). Computers have, indeed, become objects around which people form social categories and develop social identities (Hogg & Abrams, 1988).

Lippmann (1922) made us aware of the prevalence of stereotypes, and in almost seventy years of examination, the surest fact about stereotypes is their inevitability. Bar-Tal, Graumann, Kruglanski & Stroebe (1989) define a stereotype as "a set of beliefs about the personal attributes of a group of people" and provide two facts about stereotypes that are pertinent to this research: (a) all people have stereotypical views of groups of people; and, (b) stereotypes of outgroups are typically less positive than those of ingroups. It has been repeatedly shown that the group with which a person identifies will be evaluated more positively than the group with which a person does not identify (note Bar-Tall's second point above) and members of the group will tend to both defend the group and its beliefs and to reject the beliefs of the other group (Hogg & Abrams, 1988; Wilder & Shapiro, 1989). From this theoretical base, it is easier to understand why non-computer people tend to feel hostile or apprehensive when they are forced to deal with computers or computer people, and why it is so difficult for them to make an effective cognitive shift toward

positive computer attitudes, if educational or occupational pressures should require it, once they have identified themselves as non-computer people.

Research Design

Stereotype Analysis

Turkle (1984) presented a description of the classic computer person--the "hacker": male, highly intelligent, young, monomanically dedicated to programming, asocial, poor health and hygiene habits.

Other studies (Arndt, Clevenger & Meiskey, 1985; Gardner, Young & Ruth, 1989; Igbaria & Parasuraman, 1989; Koohang, 1986; Popovich, Hyde & Zakrajsek, 1987) attempted to identify the salient factors involved in the development of negative attitudes and/or apprehensions toward computers. "Computerphobes," were (suspected) to be older, female, with math and/or science anxiety and low levels of computer experience.

To identify "real world" concepts, confirmatory stereotype identification was conducted by informal interview of twenty individuals and media analysis.

Commonly accepted attributes for computer people were in agreement with the hacker profile in the literature, especially with the concept that computer people are "smart." This "smart" has the most meaning in the area of academic achievement with an emphasis on math.

Comments by some computer people on their views of non-computer people were also extremely helpful, especially in regard to the frequently heard statement that, "they [non-computer people] never listen."

Communication apprehension, considering the existing literature (Cegala, Savage, Bruner & Conrad, 1982; Daly, Vangelisti & Lawrence, 1989; McCroskey, Daly, Richmond & Cox, 1975; Pilkonis, 1977) was seen as a feature of the computer

person's stereotype communication style and it was suggested (James C. McCroskey, personal communication, 1991) that receiver apprehension might address the non-computer person's.

Based on the stereotype analysis, those features that were established as inherent in the concepts of the extremes of computer versus non-computer people, could be placed in bi-polar features, and could be adequately addressed in this research are shown in Table 1.

Table 1
Features of Computer Versus Non-Computer Stereotypes

Feature	Computer	Non-Computer
Computer Attitude *(Category Label)*	Positive	Negative
1. Gender	Male	Female
2. Academic Achievement *(Especially math)*	High	Low
3. Communication Apprehension	High	Low
4. Receiver Apprehension	Low	High

Subject Population

The primary focus of this study was placed on individuals either about to leave high school or just entering college or job training to reduce the effect of sub-cultural socialization (Hamilton, 1979). Subjects in the pilot study and study one were from a mid-size, southwestern college and a suburban high school, while study two examined apprentices in an electrician's union in a mid-sized, southwestern city.

Method

A pen and paper survey, using a combination of previously validated instruments, an original instrument and self-report, self-evaluation questions was used to collect data which were then examined through statistical quantitative analysis to establish the validity of the stereotypes.

Pilot Study

Method

Subjects. The sample was composed of 47 high school subjects and 42 college students who took the survey as part of class activities, 22 college students who received extra course credit for participation, and 12 college students took the survey on a volunteer basis, N = 123. A total of 67 males and 56 females, M = 19.9, *sd* 5.7 years participated.

Instruments

Subjects were asked for independent data on gender, expected grade (in the class where surveyed), and to rate themselves using a 5-point Likert-type scale with anchors from Very Bad (1) to Great (5) on how well they read and how good their math was. Grade, reading, and math items provided a self-rated measure of academic achievement.

The Computer Attitude Estimate (CAE) was developed from a twenty-five item, 5-point Likert-type scale anchored from Strongly Disagree (1) to Strongly Agree (5) addressing four facets of computer attitude: personal affect, education, utility, and computer people. The scale included one validity check item.

The age of the subject base affected the choice of wording of some of the attitude statements as well as the anchors for the self-ratings. For example, "Computer people need to get a life," was judged easier to relate to than "Computer people tend to become too absorbed in their work."

In addition, an independent checklist item measured any areas of prior computer experience.

The Personal Report of Communication Apprehension (PRCA-24) (McCroskey, Beatty, Kearney, & Plax, 1985) was used to measure communication apprehension. It is a well-established scale and has well-validated statistical norms.

The Receiver Apprehension Test (RAT) (Wheeless, 1975) was used to measure receiver apprehension. The scale has established validation, especially in conjunction with the PRCA-24.

Procedure

The instruments were administered in a survey packet in classroom situations. The researcher and instructors followed identical written procedures of administration. Survey completion took about 20 minutes and order of the individual scales was varied to reduce possible response bias.

Results

The CAE was examined using SPSSX Reliability functions and Factor analysis, using an eigenvalue of 1.0 and varimax rotation to develop the highest reliability alpha. After analysis, the scale was reduced to eleven items, twelve with the validity check item which produced 3 factors accounting for 60.2% of the variance and an alpha of .8431. The scale was coded such that a higher number indicated a more negative attitude toward computers and produced an $\underline{M}$ of 26.49, *sd* 7.62. All final inter-item correlations were significant ($p \leq .01$). See Appendix A for a copy of the final survey.

The independent item on computer experience and all self-report items were coded such that a higher number indicated more experience, a higher self-reported skill level and a higher grade expectation, respectively.

The PRCA-24 is coded such that a higher number indicates a higher level of apprehension. Mean and standard deviation were consistent with previous research,

M of 65.72, *sd* 15.32. Alpha was .9102.

The RAT is also coded such that a higher number indicates a higher level of apprehension. Mean and standard deviations were also consistent with previous research, M of 42.58, *sd* of 10.36. Alpha was .8871.

Self-ratings were all within acceptable frequency distributions, but of 87.8% of subjects responding to expected grade, 58.5% expected A's.

Correlation between the PRCA-24 and the RAT was .3061 ($p \leq .01$), but the PRCA-24 was not significantly correlated with the CAE. However, the RAT was significantly correlated (.2640 $p \leq .01$) with the CAE. The RAT was also more strongly inversely correlated with self-ratings of reading skills than the PRCA-24 (-.2630 $p \leq .01$ to -.2085 $p \leq .05$). The CAE (-.3344 $p \leq .01$) was inversely correlated with self-ratings of grade while computer experience was positively correlated (.2733 $p \leq .01$). Gender was not significantly correlated to Computer Attitude or prior computer experience.

Discussion

Preliminary evidence from the pilot study indicate the CAE is a reliable measure of computer attitude. It also shows that both communication apprehension and receiver apprehension are negatively correlated with self-perceptions of reading skill. This supports both research that shows that apprehension in general lowers cognitive ability (for example, Preiss, Wheeless, & Allen, 1991) and the non-computer person stereotype; it does not support the computer person stereotype.

The positive correlation of grade expectations with computer experience and inversely with the CAE, however, does support the computer stereotype.

Study One

Method

Subjects. The sample was composed of 230 high school students who took the survey as part of class activities, 46 college students who received extra course credit for participation, and 5 high school students and 10 college student who took the survey on a volunteer basis, N = 291. A total of 129 males and 162 females, age M = 17.8, *sd* 3.7 years participated.

Instruments & Procedure

The item compositions on all instruments and procedures remained the same as described in the pilot study.

Results

There were no significant differences in the number of factors or the percentage of variance from the pilot study in the scales. The CAE produced a M=27.30, *sd*=7.17, alpha=.8128; the PRCA-24 produced a M=64.26, *sd*=15.36, alpha=.9048; the RAT produced a M=42.31, *sd*=10.32, alpha=.8610.

Self-ratings of reading and math were within acceptable frequency distributions, but of 94.2% of subjects responding to expected grade 46.4% expected A's.

T-tests by gender were run on the CAE, PRCA-24, RAT and computer experience scores. To guard against Type I error, the alpha was set at .05 divided by 4 (the number of tests) resulting in an alpha of .0125. This resulted in one significant result, receiver apprehension (males more than females; T=2.85, *df*=288, $p \leq .004$).

The computer attitude t-test was clearly non-significant ($p \leq .379$), as was the prior computer experience ($p \leq .362$), but there were differences in the patterns of uses of computers reported. For example, males reported more experience with programming than females (43% to 26%).

Significant correlation between measures are listed in Table 2.

Table 2

Study One Significant Correlations

Attribute		Correlation
Academic Achievement		
Grade	-.1198*	Computer Attitude
Read	-.1771**	PRCA-24
	-.2329**	Receiver Apprehension
	.1309*	Computer Experience
Math	-.2027**	Receiver Apprehension
	-.2809**	Computer Attitude
	.2090**	Computer Experience
Communication Apprehension		
PRCA-24	.2324**	Receiver Apprehension
Receiver Apprehension	.3026**	Computer Attitude

Note. * $p \leq .05$ ** $p \leq .01$
Note. This table lists all the correlations once only. Correlations with Computer Attitude and Computer Experience will be found by looking in the right hand column.

Discussion

How valid are the stereotypes?

Gender always has strong social and communication implications, but, by the definitions of this research is not a valid attribute of either stereotype. This research does support work (Chen, 1987; Lepper, 1985; Lockheed, 1985) that shows that gender may affect what areas of computer use are considered "suitable." The issue of how gender may affect what kinds of computer activities are chosen needs to be further examination.

Academic achievement, at least by self-report evidence, is a valid stereotype attribute. This has serious educational implications. The fact that "good" students, especially those who feel confident in math, may have more positive attitudes toward computers is not problematic. The inverse proposition, that "poor" students,

especially those who do not feel confident in math, may have more negative attitudes, may be. For years, educators have touted one of the major advantages of computers as being their possible use in remedial tutoring (Bass, 1989). The question of how a negative computer attitude on the part of the student might affect such tutoring needs to be addressed.

Communication apprehension is not a valid stereotype attribute in this sample. This finding does not address the question of whether communication apprehension is common in people who choose computer-oriented careers. Communication apprehension has long been shown to be a major factor in career choice (Daly & McCroskey, 1975) and math-oriented, technical fields have, as this research has shown, an aura of "suitability" for apprehensives. Perceptions of how much communication is required is a part of how people decide if they are the "right type" for the job or career, and stereotypes are a major part of how those perceptions are formed. Therefore, what we think is true, becomes true. "Nerds" do exist; Turkle (1984) did not make them up. But, as with gender, this factor appears to be more one of social constraint than inherent attribute.

Receiver apprehension is a valid stereotype attribute from these data. High levels of receiver apprehension are significantly correlated with low self-ratings on reading and math. Receiver apprehension is also significantly correlated with negative computer attitude. The following table illustrates the correlation between receiver apprehension and computer attitude at different levels of apprehension (divisions made at 1 *sd* above and below the mean):

Table 3

Study One Receiver Apprehension Correlate with Computer Attitude

	Receiver Apprehension		
	High	**Medium**	**Low**
Computer Attitude	.5261**	.1724*	n.s.

Note. * $p \leq .05$ ** $p \leq .01$; Low: $\underline{n} = 42$, Medium: $\underline{n} = 197$; High: $\underline{n} = 51$; $\underline{N} = 290$.

Implications of these findings will be discussed further in the conclusion section of this research.

A point of concern in the pilot study, and study one, is the generalizability of this research. All of the subjects were either college students or attended a suburban high school that emphasized college preparation and where many were in honors classes. Grade expectations were high. For this reason, a second, smaller study was conducted to examine these factors in a distinctly different context.

Study Two

Method

Subjects. The co-ordinator of an electricians' union's apprentice program was willing to allow subject solicitation for this research because the union was in the process of attempting to raise the performance of their apprentices and considering the use of computers. Although electricians' unions have traditionally had very high admissions standards for their apprenticeship training, the local had had to lower their standards in recent years because of a declining candidate pool. This included accepting candidates with GED's instead of diplomas. According to the coordinator, many of the "really good students" were going into electronics and/or computers. Unfortunately for their organization, lowering the admissions standards had resulted in several people being in the program who were apparently not going to be able to pass the licensing exam.

Although there were several potential problems with this sample, almost exclusively male, for one, they did offer "real world" data, a guaranteed sample of less successful students, and an opportunity to examine the stereotypical math/computer relationship more closely. One of the few admissions qualifications the union had been unable to compromise was a requisite high aptitude for math.

The survey was taken as a volunteer class activity by 33 apprentices and 3

instructors (male); 33 males and 3 females; N = 36. Ages ranged from 19 to 71 with a M of 28.4, mode of 22.0, and *sd* of 9.9 years.

Instruments & Procedure

The item compositions on all instruments and procedures remained the same as described in the pilot study.

Results

There were no significant differences in the number of factors or the percentage of variance from the pilot study in the scales. The CAE produced a M=27.83, *sd*=6.30, alpha=.8223; the PRCA-24 produced a M=68.31, *sd*=14.67, alpha=.9069; the RAT produced a M=46.25, *sd*=10.24, alpha=.8719.

Self-ratings of grade, reading, math, and interpersonal skill were all within acceptable frequency distributions, but only 61.1% of subjects responded to expected grade; 31.8% of those expected A's, 19.4% of the total sample.

Significant correlation between measures are listed in Table 4.

Table 4

Study Two Significant Correlations

Attribute		Correlation
Academic Achievement		
Read	-.4215*	Receiver Apprehension
	-.5616**	Computer Attitude
Math	-.3316*	Receiver Apprehension
	-.3743*	Computer Attitude
Communication Apprehension		
PRCA-24	.3699*	Receiver Apprehension
Receiver Apprehension	.6248**	Computer Attitude

Note. * $p \leq .05$ ** $p \leq .01$

Note. This table lists all the correlations once only. Correlations with Computer Attitude and Computer Experience will be found by looking in the right hand column.

Discussion

The major findings in study one are replicated in study two and provide evidence for the generalizability of the research. It appears that the sample with more known academic difficulties had even higher levels of both communication apprehension and receiver apprehension and more negative attitudes to computers, despite their established math abilities.

Research Conclusions

This research has emphasized very quantitative methods, but the results have very qualitative implications. The finding that receiver apprehension is a factor in self-ratings of academic achievement and computer attitude has educational implications that should be considered as well as the implications for computer-related employment situations.

There is previous research on communication apprehension and receiver apprehension and their affects on cognition, student performance and retention that shed light on these findings. (Ericson & Gardner, 1992; McCroskey, 1984; McCroskey & Andersen, 1976; McCroskey, Booth-Butterfield, & Payne, 1989; Preiss, Wheeless, & Allen, 1991). The increase in means on the PRCA-24 and the RAT from the pilot study and study one to study two, indeed, may be best explained by expanding the argument advanced by Preiss, Wheeless, & Allen (1991). That is, research has shown a decrease in receiver apprehension score means as education level increases and they feel this can best be viewed as the effect of highly apprehensive people leaving the educational system. Although this trend is supported by these findings, there is also the possible confound that the second study was composed almost entirely of males, who were significantly higher than females in receiver apprehension in the first study. This needs further study, but has implications for the study of student retention.

Since academic achievement was measured through self-ratings, study two also presents evidence on a finer point in the question of the validity of the stereotypes. Although the sample in study two had some academic problems, all had been screened for math aptitude. They were all certifiably above average in math skill, but 67% rated themselves average or below. This gives some insight into the math aspect, and by inference all academic aspects, of the computer person stereotype and computer attitude in general as well as the question of receiver apprehension. The question of self-evaluation versus external evaluation in the still unanswered etiology of receiver apprehension reflects this problem of self-reflexive concepts. Priess, Wheeless & Allen (1991) discuss this question of etiology more fully (page 168), but the question of whether a person actually has difficulty receiving information or believe they do (and thus cause it) needs address.

These academic questions may also be close to the heart of many problems of receiver apprehensive non-computer people. Fischer (1970) said that anxiety was a state of uncertainty where the world "tantalizes and tortures." The anxious, or apprehensive, individual wants something they are not sure they can acquire. In the case of receiver apprehension, especially in the academic setting, the most likely thing desired is knowledge. The research interprets receiver apprehension as a cognitive impairment (Preiss, Wheeless, & Allen, 1991); it is likely the individuals who are aware of their own limitations interpret it the same way. After all, a basic assumption of our society is that "smart" people "get it" and "dumb" people "don't." Our entire educational system is designed on the assumption that the student will spend most of the time passively reading or listening in order to obtain knowledge. The difficulty is that whether it is the initial self-perception of an inability to "get it" that causes the apprehension or whether some "other" source of apprehension causes cognitive impairment that makes it more difficult to initially "get it," the end result is the judgment by society, and usually by the individual, of "dumb." The preliminary

stereotype analysis of this research indicated that many people believe "dumb" people aren't computer people--"smart" people are.

Of course, shorn of the direct effects of apprehension, it has been shown that apprehension has no significant correlation with intelligence (Watson & Monroe, 1990). This may be, however, totally irrelevant. It is the individual's self-perceptions that are the most important part of the interaction. People judge themselves and can alter their external perceptions to fit those internal judgements (Carver & Scheier, 1986). For closure it can be noted that altered perceptions are one basis for the formation of stereotypes (Barker, 1984).

As for the formation of negative attitudes toward computers, it could be argued that computers, at least, pass no judgements. This too, for the same reasons, may be totally irrelevant to the receiver apprehensive user. As one frustrated non-computer person described it, "Every time the computer goes 'beep!' I know it's saying, 'Dummy!'"

On a positive note for further research, computers may offer some help as a tool in the understanding of what actually happens in receiver apprehension. As Preiss, Wheeless, and Allen (1991) noted, we are still unable to identify the antecedents of receiver apprehension or supply a theoretical explanation for it. Since human-computer interaction can be "controlled" far more than human-human interaction, such research may benefit the understanding of this condition. Many receiver apprehensives use the computer successfully, and like it. Their coping methods may be valuable research. Communication training in general may be of benefit. Papa (1989) reported success in improving performance on new computers systems by providing communication training, including listening skills.

It is disturbing to find a "kernel of truth" (Brigham, 1971) in a stereotype that is negative, but it should be remembered that this is only one factor in a very complicated social interaction. The assumption that something should be done to remove receiver apprehension from that interaction is not based on the assumption that computers are "good." There is no evaluation of good or bad in deciding to use or not use computers. It is simply that apprehension of any kind should not be part of the decision.

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Appendix A

The following are statements about computers. Please circle the number that shows how much you agree or disagree with each statement.

(1) Strongly Disagree
(2) Disagree
(3) Undecided
(4) Agree
(5) Strongly Agree

1.	I am certain I could work well with a computer.	1	2	3	4	5
2.	Sometimes I'm afraid I'll look dumb if I try to use a computer.	1	2	3	4	5
3.	Computers are soft and fuzzy to touch.	1	2	3	4	5
4.	Computers are fun machines.	1	2	3	4	5
5.	Working with a computer makes all kinds of work easier.	1	2	3	4	5
6.	I feel my life can be lived just fine without computers.	1	2	3	4	5
7.	I resent being told that "computers don't make mistakes."	1	2	3	4	5
8.	I would enjoy having a computer in my home.	1	2	3	4	5
9.	Computer people need to get a life.	1	2	3	4	5
10.	I am worried about being made to use a computer in order to get an education.	1	2	3	4	5
11.	Computers make me feel very frustrated.	1	2	3	4	5
12.	Sometimes I feel computers are out to get me.	1	2	3	4	5

These are questions about your prior experience with computers.

Have you ever worked or played with computers?
(circle one) Yes No

If yes, check all the things that apply from the following list:

- games? ____
  What kinds? _____
- course on computer theory? (like computer basics) ____
- course on application program? (like word processing) ____
- course on something else where computers were used? ____
  What course? _____
- course on programming? ____
  What computer language(s)? _____